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BOARD # 472: Works-in-Progress: Engaging S-STEM Scholars in Cohort-based Mentoring and Social Impact Projects

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Work-in-Progress: Engaging S-STEM Scholars in Cohort-based Mentoring and Social Impact Projects[1]

Program Overview

The University at Buffalo (UB) Scholars in Science Technology Engineering and Math (S-STEM) program, Engineering Design Innovation (EDI), supports 25 financially vulnerable students (20 undergraduate students and 5 undergraduate students), all selected based on two key criteria: 1) academic excellence and 2) a commitment to understanding and improving the social impact of computing and engineering. Our cohort (described below) receives last dollar scholarships and participates in a range of wrap around supports aimed at retaining and supporting these excellent students. The EDI scholars:

- Have a faculty mentor and small 4-5 person mentoring cohorts, tasked with meeting at least twice each semester with the students[1];
- Participate in monthly professional development and community-building sessions, in which all scholars gather to engage with essential topics and activities, like: building a solid resume, understanding the social impact of engineering and computing, understanding stress and burnout, and planning for summer success;
- Are offered the opportunity to attend the EDI Summer Institute as a community-engaged researcher in engineering or computing[2], [3].

This work-in-progress paper reports the current formative data helping shape the research team's plans for year 2 of the S-STEM EDI program. Our formative assessment includes both semesterly review of grades as well as annual student reflections and adapted sense-of-belonging data collection. Cohort-based curricula, and peer mentoring are all strategies used to establish and increase students' sense of belonging in engineering[4]–[8]. Sense-of-belonging is counter to the experience of many students, but particularly students from ethnic, racial, and gender minority populations, whose enculturation into STEM communities is often characterized by ostracization, exclusion, and microaggression[6]. Our S-STEM approach seeks to increase students' sense of belonging, self-efficacy, integration into their academic community, and development of an engineering and computer science identity.

Cohort Overview

Our S-STEM cohort was recruited using the UB enrollment platform (SLATE), and all eligible students were given the opportunity to apply to the program. Eligibility was determined based upon major (for undergraduates, any UB School of Engineering and Applied Sciences (SEAS) major; for graduate students Engineering Science or Biomedical Engineering) and financial need. Application review was handled holistically with the research team reviewing all candidates. Candidates were selected based upon their experience with community-based projects (especially those tied to engineering and computing) and their ability to articulate the need for engineering and computing to respond to societal challenges. For example, the students we selected were often able connect the work of engineers to climate change challenges or the design of infrastructure in their city to the decisions of engineers[2]. In short, our cohort was designed to be a set of excellent scholars who could form a coalition of STEM professionals with a critical and deep understanding of the connection between their work and the communities they work and live in.

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[1] Acknowledgement

This work is supported by the National Science Foundation Grant 2221556. Any opinions, findings, conclusions, or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

[2] Focused work on engineering and social impact will begin in Summer 2025, when we have our first Summer Institute.

The resulting cohort is remarkably diverse in race, gender, and major (See Tables 1, 2, and 3, respectively). Ten of our students do not identify as racial minorities, and eight identify as gender minorities. The majors of the cohort lean computer science, but also represent mechanical engineering, civil and structural engineering, biomedical engineering, among others.

Table 1. Cohort by Self-identified Race/Ethnicity	
Self-Identified Race	**Count**
White	5
Asian	10
Black/African American	2
Unknown	4
Native American Indian or Alaska Native	1
Mexican, Hispanic, or Latino	3

Table 2. Cohort by Self-Identified Gender	
Self-Identified Gender	**Count**
Women	8
Men	17

Table 3. Cohort by Major	
Majors	**Count**
Computer Science and Engineering BS	6
Computer Science and Engineering MS	4
Computer Engineering BS	2
Aerospace and Mechanical BS	4
Biomedical Engineering BS	2
Civil Engineering BS	3
Electrical Engineering BS	1
Engineering Science BS	1
Neuroscience BS	1

Retention and Academic Success Data

To date, all of our students have stayed in STEM, with three of the students leaving UB for a different institution (but staying in higher education and STEM). The three students have been contacted for post-mortem interviews to better understand their departure from our university; since their departure, the S-STEM team has recruited three new undergraduate scholars into the cohort using the same criteria and the same applicant pool.

Student success has been tracked on a semesterly basis, with intentional mentoring and success support offered to any student who either expresses (through communication with the study team or mentors) or demonstrates (through grades) the need for support. These wide supports include small groups and tutoring to support success with math and physics, frequent check ins with mentors and both academic and faculty advisors. For Spring 2024, all but three of the S-STEM students achieved a GPA of higher than 2.8, which is the criterion for remaining on the S-STEM scholarship (see Figure 1). Those three students were put on probation with purposeful success programs put in place to support their success. By the end of Fall 2024, two of the three have successfully met or exceeded the plans put into place by the S-STEM team.

Students' cumulative GPAs cohere around the 3.0 and 3.5 mark, despite the relatively lower Fall 2024 mean GPA (see Figure 2).

Figure 1. Student GPAs by Semester and Cumulatively

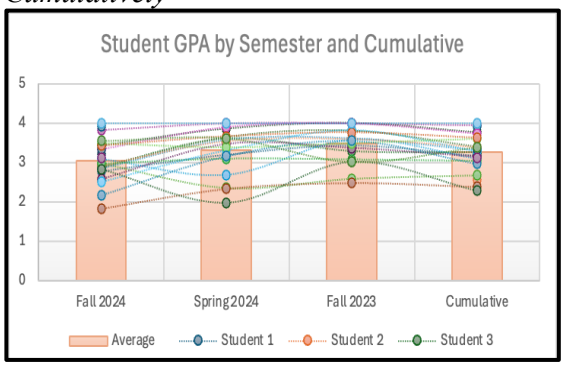
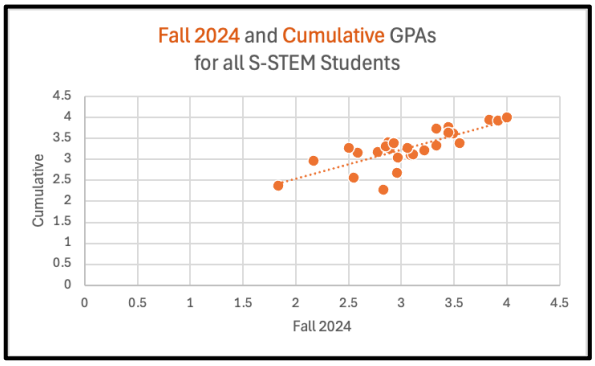


Figure 2. Fall 2024 GPAs mapped alongside Cumulative GPAs



Sense of Belonging Data – Year One

One indicator for our formative assessment is sense-of-belonging of the students, who have been cohorted in small groups for the duration of their projects. The project's sense-of-belonging instrument was adapted from Leibowitz' survey instrument[9], which was designed specifically to understand students' experiences in a learning community. Although we do not have an official learning community for the S-STEM students, our small groups and cohort model aim to connect students to the EDI project and their cohort more specifically. Therefore, the Leibowitz instrument was an appropriate basis for our formative assessment purposes. At the end of their first year, we reached out to students to better understand how they feel about their sense of belonging within the S-STEM/EDI cohort and the university as a whole. In general, student responses have been positive and reflect a strong connection among the participants.

S-STEM/EDI Cohort (see Figure 3)

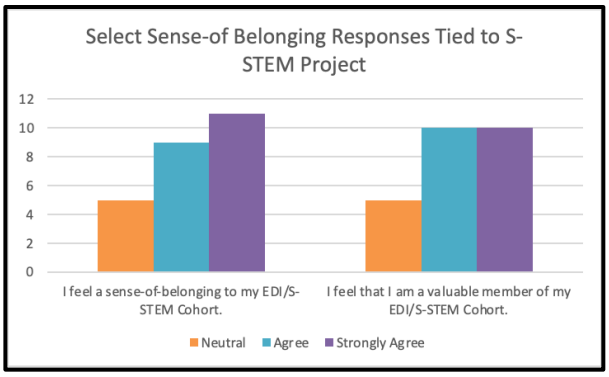
- Most students indicated a strong sense of belonging to their cohort, with a majority rating it a 4 or 5.
- When asked whether they felt like valuable members of the cohort, the responses mirrored this positivity, with most participants giving high ratings.

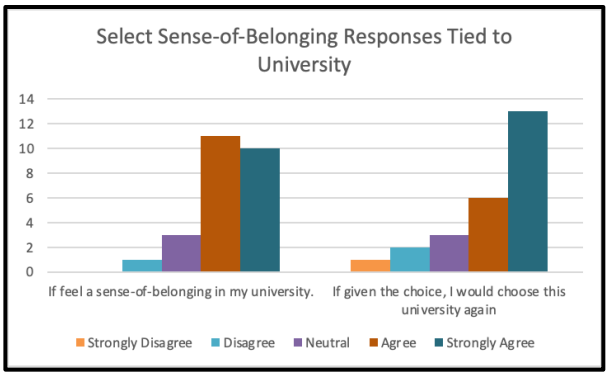
University Community (See Figure 4)

- Students expressed a solid sense of belonging to the university, with a significant number choosing ratings of 4 and 5.
- Furthermore, when asked if they would choose the same university again, the responses were overwhelmingly positive. Many students rated this with the highest score of 5, which speaks to their satisfaction with their choice.

Figure 3. S-STEM Sense of Belonging

Figure 4. University Sense of Belonging





Narrative Reflections -- Year One

The S-STEM program has significantly enhanced students' sense of belonging, self-efficacy, and academic integration through cohort-based mentoring and participation in affinity and opportunity programs. Students highlighted the transformative impact of faculty mentors, research experiences, and peer connections on their personal growth, academic success, and future aspirations. These supports not only helped students overcome challenges but also inspired many to consider advanced studies and pursue their passions confidently.

Struggles and Challenges in the First Year

Student struggles were described both in terms of their transitions and their ability to manage priorities. Sample quotes include:

- *"I struggled with my classes at the beginning of the year because I had never really had to try in high school, and everything was dumbed down for my school. I did not know how to study or do anything when the teacher was not explicitly telling me what to do."*
- *"My friends had not been in a school system like mine, so they knew what to do and how to do it. It felt like I was stupid."*
- *"My first semester was a struggle due to being placed in a new environment with significantly harder academics. I was trying to balance a developing social life and setting my own schedule."*

Yet, the S-STEM program seemed to help offer some additional support.

- "*Once I started to settle in with a group of people, it made time management significantly easier, allowing me to plan out and achieve good grades."*
- *"In ending research, the greatest struggle was being persistent and gaining the courage to reach out. I am reserved, so it made this difficult, but keeping my goal in mind forced me to reach out."*

Support from Affinity and Opportunity Programs

Affinity and opportunity programs played a significant role in supporting S-STEM scholars' retention and overall college experiences. These programs provided students with access to additional resources, mentorship, and opportunities to build meaningful connections with peers and faculty. Sample quotes include:

- *"The WiSE program also had a huge impact on me. It allowed me to meet other girls who had similar passions and interests as me, which not only gave me the encouragement I needed but also introduced me to some of my closest friends.*
- *"Recently, I met a member of the Hispanic engineering society that encouraged me to continue expanding my college experience by joining their club, and my RA Roy has welcomed me to the drivers club at UB."*

Finding Success with Faculty Mentors

Faculty mentors had a profound impact on the academic journeys and aspirations of S-STEM scholars, serving as both role models and sources of inspiration. Sample quotes include:

- *"Researching with Professor Negar Elhami-Khorassani over the summer was incredibly inspiring...The way she thinks and displays her work has me in awe and encouraged me to think about grad school after my undergrad."*
- *"Professor Joseph has been really influential to me, not only because his field is similar to what I am interested in and it shows me what I can do with what I'm passionate about, but I was also able to get a TA position in his seminar class because of this connection."*

Conclusion

This work-in-progress paper reports formative data we have used to assess the EDI scholars S-STEM program at our university. Based upon this data, we are increasing the academic support for students who need it by applying for supplemental funds to hire a success coach specifically for our EDI students as they continue to develop strategies for academic success at our university. Additionally, we are establishing opportunities to move the cohort towards a community of practice focused on engineering and computing for social good, hoping to solidify the relationships students are building. Finally, we are working with mentors to better support their interactions with students.

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